



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/758,150	01/15/2004	Chee Hong Choi	20063/OG03-018	4636
34431	7590	06/13/2005	EXAMINER	
HANLEY, FLIGHT & ZIMMERMAN, LLC 20 N. WACKER DRIVE SUITE 4220 CHICAGO, IL 60606			LEE, CALVIN	
			ART UNIT	PAPER NUMBER
			2818	
				DATE MAILED: 06/13/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/758,150	CHOI, CHEE HONG	
	Examiner	Art Unit	
	Lee, Calvin	2818	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 5/31/05 (Amendment).

2a) This action is **FINAL**. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 11-20 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 11-20 is/are rejected.

7) Claim(s) _____ is/are objected to.

8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on 31 May 2005 is/are: a) accepted or b) objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) All b) Some * c) None of:
1. Certified copies of the priority documents have been received.
2. Certified copies of the priority documents have been received in Application No. _____.
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) Notice of References Cited (PTO-892)
2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date

4) Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____ .
5) Notice of Informal Patent Application (PTO-152)
6) Other:

FINAL ACTION

Response to Amendment

1. The cancellation of claims 1-10 and the addition of claim 11-20 in the amendment, received on May 31, 2005, are acknowledged.

Specification

2. The disclosure is objected to because of the following informality:

Replace, in ¶ 0015, “an upper metal layer 15 and a dielectric layer 14 are deposited in sequence” with --a dielectric layer 14 and an upper metal layer 15 are deposited in sequence--

Claim Objections

3. Claims 11 and 12 are objected to because of the following informalities:

Claim 11, line 6, replace “an upper metal layer disposed” with --a dielectric layer disposed--

Claim 12, line 2, replace “on the dielectric layer” with --on the upper metal layer--

Claim 11, line 8, replace “a dielectric layer disposed on the upper metal layer” with --an upper metal layer disposed on the dielectric layer-- Appropriate correction is required.

Claim Rejections - 35 U.S.C. § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

5. Claims 11 and 15-17 are rejected under 35 U.S.C. 102(e) as being anticipated by *Kim*.

Kim (US 2004/0137693) discloses a method for fabricating an MIM capacitor, comprising:

- depositing a dielectric layer 25 on a metal layer 23, which has been formed as a lower electrode 23a of an MIM capacitor 40 [Fig. 2A]
- removing some part of the dielectric layer to form the MIM capacitor thereon [paragraph 0024]
- depositing an MIM dielectric 29 and an upper metal layer 31 [Fig. 2B]
- forming the MIM capacitor by patterning the MIM dielectric and the upper metal layer [Fig. 2D]

Admittedly *Kim* is silent about a sacrificial layer. However, the Examiner notes that Applicant discloses “the sacrificial layer is used as an etch stopping layer ... silicon oxide or silicon nitride” [¶ 0014]. In *Kim*’s, “the dielectric layer 25 is [also] used as an etching stopper (which meets claim 5)... comprises an oxide film or nitride film (which meets claim 6)” [¶ 0024].

Therefore, *Kim* inherently teaches or suggests a sacrificial layer 25, which is eventually removed a portion for subsequent deposition of the MIM.

Claim Rejections - 35 U.S.C. § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 12, 18, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Kim*, as applied to claim 1, in view of *Applicant' Prior Art (APA)*.

a) *Kim* does not disclose such process steps as:

- forming a via hole by depositing and patterning an interlayer dielectric after forming the MIM;
- depositing a barrier metal layer on the via hole;
- filling the via hole with a metal;
- flattening the via hole; and depositing and patterning a metal layer.

Nevertheless, such interconnect on top of an MIM capacitor is known in the semiconductor processing art as evidenced by *APA* disclosing an interconnect comprising the steps of forming a via hole by depositing and patterning an interlayer dielectric 6; depositing a barrier metal layer 7; filling the hole with a metal plug 8; depositing and patterning a metal layer 9 on the flatten interconnect 8 [Figs. 1D-1F].

It would have been obvious to one having ordinary skill in the art to have modified the MIM formation of *Kim* by utilizing an interconnect on top for the purpose of electrically connect the MIM capacitor to the outside packaging lead.

b) In re claims 18 and 20, *Kim* is silent about the materials of the dielectric layers and the MIM upper/lower electrodes. *APA* discloses the MIM dielectric layer 44 of SiN [¶ 0004]

It would have been obvious to one having ordinary skill in the art to have modified the dielectric material of *Kim* by utilizing the claimed material because it appears as if any dielectric material including the claimed material would work equivalently to any other well-known dielectric material as long as the desired dielectric material is capable to insulate between the MIM upper and lower electrodes.

Neither *Kim* nor *APA* suggests that the upper and lower metal layers of the MIM capacitor are made of at least one of aluminum and a transition element.

It would have been obvious to one having ordinary skill in the art to have modified the electrode material of *Kim* and *APA* by utilizing the claimed material because it has been held to be within the general skill of a worker in the MIM art to select a known metal on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 SUPQ 416.

8. Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Kim* and *APA* in view of *Noguchi et al* (US 2004/0152256).

The combination of *Kim* and *APA* suggests neither the interconnect metal being selected from the group of tungsten, copper family elements, and platinum family metals, nor the barrier metal layer being made of a high fusion point metal or nitride thereof, and wherein the barrier metal layer is configured to have one of a single layer structure and a multi-layer structure.

a) In re claim 13, *Noguchi et al* discloses an MIM capacitor [¶ 0090] followed by an interconnect [Fig. 18 and ¶ 0098] having an interconnect metal 57 of copper or copper alloy.

It would have been obvious to one having ordinary skill in the art to have modified the metal material of *Kim* and *APA* by utilizing a copper metal for the purpose of better interconnect.

b) In re claim 14, *Noguchi et al* also discloses the MIM capacitor followed by the interconnect [Fig. 18 and ¶ 0098] having the interconnect metal 57 made on a barrier metal layer 56 (of the same material as the conductive barrier layer 18), i.e., high-melting point metal nitride such as WN, WSiN ... may be either a single layer film or a laminated film [¶ 0072].

It would have been obvious to one having ordinary skill in the art to have modified the barrier material of *Kim* and *APA* by utilizing a high-melting point metal nitride for the purpose of better suppressing or preventing diffusion of copper.

Response to Arguments

9. Applicant's argument that "*Kim* does not disclose that an upper metal layer is disposed on the substrate" is not persuasive. However, the invention is directed to an MIM capacitor comprising a dielectric layer 14 sandwiched between a lower metal layer 11 and an upper metal layer 15. The examiner believes that the applicant mistakenly labeled "dark layer" 14 in Figs. 2 as the "upper metal layer", which unintentionally has an electrical contact with its lower layer 11.

Hence, the structure now turns out to be a multilayer contact 11, 14, which is totally different than a Metal-Insulator-Metal. *Kim* undeniably reads on the invention feature of an MIM being improved with the claimed sacrificial layer partially covered the lower metal layer.

In conclusion, the same rejections have been made FINAL because the new claims 11-20 contain such new issue(s) as: "an upper metal layer disposed on the lower metal layer ... dielectric layer disposed on the upper metal layer."

10. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire three months from the mailing date of this action. In the event a first reply is filed within two months of the mailing date of this final action and the advisory action is not mailed until after the end of the three-month shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than six months from the date of this final action.

Contact Information

11. Any inquiry concerning this communication from the Examiner should be directed to *Calvin Lee* at (571) 272-1896 on Mondays thru Thursdays 6:30-4:30PM. If attempts to reach the examiner by telephone are unsuccessful, Art Unit 2818's Supervisory Patent Examiner *David Nelms* can be reached at (571) 272-1787. The fax phone number for the organization (where this application is assigned to) is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system at <http://pair-direct.uspto.gov>. Should you have questions on access to the PAIR system, contact the Electronic Business Center at (866) 217-9197.



David Nelms
Supervisory Patent Examiner
Technology Center 2800

CL
Date: June 9, 2005